National Aeronautics and
Space Administration

Principal Center for Regulatory Risk Analysis and Communication

REGULATORY SUMMARY

Proposed Rule: Transportation of Lithium Batteries

This information was prepared by NASA's Principal Center for Regulatory Risk Analysis and Communication (RRAC PC). If you have further questions or need assistance, please contact the RRAC PC Manager, Sharon Scroggins (256-544-7932, sharon.scroggins@nasa.gov).

Executive Summary

On 11 January 2010, the U.S. Department of Transportation's (DOT's) Pipeline and Hazardous Materials Safety Administration (PHMSA) published in the *Federal Register* (FR) proposed amendments [75 FR 1302] to the Hazardous Materials Regulations (HMR), which is codified in the *Code of Federal Regulations* (CFR) at 49 CFR 100-185. The proposed amendments, which were developed in consultation with the Federal Aviation Administration (FAA), address the transportation of lithium cells and batteries, including lithium cells and batteries packed with or contained in equipment.

The proposed rule includes additional requirements to enhance safety of lithium batteries under normal transportation conditions. The proposed requirements are largely consistent with changes made to the United Nations Recommendations on the Transport of Dangerous Goods ("UN Recommendations") and the International Civil Aviation Organization Technical Instructions on the Safe Transport of Dangerous Goods by Air ("ICAO Technical Instructions") and respond to recommendations issued by the National Transportation Safety Board (NTSB). The comment deadline for the proposal is 12 March 2010. PHMSA has proposed a mandatory compliance date of 75 days after the final rule is published in the FR. This proposed rule would not affect passengers who carry lithium batteries in portable electronic devices during air travel.

Potential Impacts to NASA

If the amendments are finalized, NASA would be required to adhere to the new requirements when shipping lithium batteries packed with or contained in equipment. Should you have comments about the proposed rule, please provide them to the RRAC PC Manager, Sharon Scroggins, before 5 March 2010.

Background

Lithium batteries can present both chemical and electrical hazards in transportation. Batteries that are misused, mishandled, improperly packaged, improperly stored, overcharged, or defective can overheat and ignite.

Lithium batteries fall into two categories: lithium metal, including lithium alloy (also known as primary lithium batteries); and lithium ion, including lithium ion polymer (also known as secondary lithium batteries). Lithium metal batteries contain a small amount of metallic lithium or a lithium alloy, are typically nonrechargeable, and often are used in medical devices and computer memory, and as replaceable batteries (AA and AAA sizes) suitable for electronic

devices. Lithium ion batteries contain a lithium compound (e.g., lithium cobalt dioxide, lithium iron phosphate) and generally are rechargeable. Lithium ion batteries often are found in portable computers, mobile phones, and power tools.

The proposed rule is intended to address the root causes of lithium battery incidents and to include requirements consistent with UN Recommendations, ICAO Technical Instructions, and NTSB recommendations. The available incident data suggest that the most likely causes of lithium battery incidents include the following:

1. **External short circuiting**–occurs when an exposed battery terminal contacts a metal object.

2. **In-use situation**–generally relating to improper ''charging'' or ''discharging'' conditions associated with the use of equipment (computer or cell phone). This also includes inadvertent activation and subsequent overheating (such was the case when a power drill activated and burned in a passenger's checked baggage).

3. **Noncompliance**–includes faulty design of the battery (cells or battery packs), false certification of compliance with regulatory testing and classification requirements, and improper packing and handling, including some counterfeit batteries.

4. **Internal short circuit**–can be caused by foreign matter introduced into a cell or battery during the manufacturing process or when a battery is physically damaged (dropped or punctured).

Existing Regulations

Currently, the HMR addresses lithium battery transportation safety through design type testing, short-circuit protection, limits on battery size, and limits on net and gross weight. Exceptions are provided for small cells and batteries typically found in consumer electronic devices.

Lithium batteries are regulated as a Class 9 material. Class 9 materials are those that present a hazard during transportation, but do not meet the definition of any other hazard class. The HMR prohibits the transport of primary lithium batteries as cargo on passenger aircraft unless packed with or contained in equipment.

For transportation by all modes, lithium batteries of all types and sizes must pass applicable tests in the UN Manual of Tests and Criteria to verify that the battery can withstand normal conditions encountered in transportation. Batteries must be designed to prevent violent rupture, must be equipped with an effective means of preventing external short circuits, and include a means to prevent reverse current flow if it contains cells that are connected in parallel.

Batteries transported as Class 9 materials must be packaged in combination packagings that conform to the performance standards specified in 49 CFR Part 178 at the Packing Group II performance level. Additionally, batteries:

- Must be packaged so as to prevent short circuits, including movement that could lead to short circuits.
- Must be labeled with a Class 9 label and must be accompanied by a shipping paper that describes the lithium batteries being transported and emergency response information.
- Must have the location and quantity of shipments provided to the pilot in command.

Small Lithium Batteries

The HMR provides exceptions for lithium batteries based on the battery size and packing method. Shipments of small lithium batteries are not required to meet the packaging and labeling requirements listed above, provided that each package containing more than 24 lithium cells or 12 lithium batteries is:

- Marked to indicate that it contains lithium batteries and that special procedures must be followed if the package is known to be damaged.
- Accompanied by a document indicating that the package contains lithium batteries and that special procedures must be followed if the package is known to be damaged.
- Weighs no more than 30 kilograms.
- Capable of withstanding a 1.2-meter drop test in any orientation without shifting of the contents that would allow short-circuiting and without release of package contents.

Furthermore, each such package that contains a primary lithium battery or cell forbidden for transport aboard passenger carrying aircraft must be marked: "PRIMARY LITHIUM BATTERIES—FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" or "LITHIUM METAL BATTERIES—FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT."

The marking, documentation and 1.2-meter drop test requirements described above do not apply when these small cells or batteries are enclosed in a piece of equipment.

Medium Lithium Batteries

For medium-sized lithium batteries and cells transported by motor carrier or rail, the HMR provides exceptions similar to those for small lithium batteries (49 CFR 172.102 Special Provisions 188 and 189). Under these exceptions, a package containing medium-sized lithium batteries and cells of all types must:

- Be marked to indicate it contains lithium batteries and special procedures must be followed if the package is known to be damaged.
- Be accompanied by a document indicating the package contains lithium batteries and special procedures must be followed if the package is known to be damaged.
- Weigh no more than 30 kilograms.
- Be capable of withstanding a 1.2-meter drop test.

For those packages that are not prepared for air shipment (not offered and transported as a Class 9 material), the HMR requires the packages to be marked to indicate that they may not be transported by aircraft or vessel. The marking, documentation and 1.2-meter drop test requirements described above do not apply when these medium cells or batteries are contained in a piece of equipment.

Summary of the Proposed Rule

PHMSA is proposing several requirements to strengthen the regulations for the safe transportation of lithium batteries. The following amendments are being proposed:

- Require a shipper, carrier, package owner or person reporting an incident under the provisions of 49 CFR 171.15 or 171.16 to cooperate and support investigation of the incident by an authorized representative, if requested.
- Revise current shipping descriptions for lithium batteries (UN3090), lithium batteries packed with equipment (UN3091), and lithium batteries contained in equipment (UN3091) to specify lithium metal batteries including lithium alloy batteries, as appropriate. Adopt shipping descriptions for lithium ion batteries including lithium ion polymer batteries (UN3480); lithium ion batteries packed with equipment including lithium ion polymer batteries (UN3481); and lithium ion batteries contained in equipment including lithium ion polymer batteries (UN3481). Currently, under the HMR, lithium metal batteries and lithium ion batteries share the same UN number, but each behaves differently when exposed to fire. Additionally, lithium metal and lithium ion batteries are regulated differently, but currently share the same shipping description. This situation could cause problems in acceptance procedures for carriers and might unnecessarily hinder or delay the transportation of these products. Separate entries for lithium metal and lithium ion batteries would facilitate the proper handling and emergency response actions.
- Adopt watt-hours in place of equivalent lithium content to measure the relative hazard of lithium ion cells and batteries consistent with proposals already adopted in the UN Recommendations, ICAO Technical Instructions, and International Maritime Dangerous Goods (IMDG) Code. [correct spell out??]
- Incorporate by reference the latest revisions to the UN Manual of Tests and Criteria applicable to the design type testing of lithium cells and batteries.
- Adopt and revise various definitions including ”aggregate lithium content,” ”lithium content,” ”lithium ion cell or battery,” ”lithium metal cell or battery,” ”short circuit,” and ”watt-hour” based on definitions found in the UN Manual of Tests and Criteria.
- Require manufacturers to retain results of satisfactory completion of UN design type tests for each lithium cell and battery type and place a mark on the battery or cell to indicate that testing has been completed successfully.
- Eliminate the regulatory exceptions for lithium cells and batteries when transported aboard aircraft, consistent with NTSB Safety Recommendation A–07–109. The HMR includes exceptions (Special Provision 188 in 49 CFR 172.102(c)) for small lithium cells and batteries provided that the cells or batteries meet the test requirements in the UN Manual of Tests and Criteria and the shipment conforms to minimal packaging and hazard communication requirements. The proposed rule calls for small lithium batteries and cells to be transported as Class 9 materials and be subject to the requirements for lithium cells and batteries in 49 CFR 173.185, including the packaging, labeling, shipping papers, and package marking and labeling requirements that apply to shipments of Class 9 materials.

- For air transportation, eliminate regulatory exceptions for lithium cells and batteries. Other lithium cells and batteries packed with or in equipment may be exempt from only the enhanced packaging requirements if they are packaged in a way to prevent short circuiting and if the ratio of batteries to equipment is at or less than three-to-one. Standard Class 9 marking, labeling, and documentation would apply if shipped by air. Notification of the pilot in command of the aircraft is to be made regarding the presence and location of lithium batteries on the aircraft.
- For all transport modes, require lithium cells and batteries to be packed to protect the cell or battery from short circuits. DOT is proposing to require lithium cells and batteries to be transported in inner packagings of combination packagings that completely enclose the cell or battery to isolate the conductive terminals of batteries from each other.
- Unless transported in an FAA-approved container, when transported aboard aircraft, limit stowage of lithium cells and batteries to crew accessible cargo locations or locations equipped with an FAA-approved fire suppression system. DOT also is considering whether imposing a limit on the number of lithium battery packages transported in a single aircraft, single compartment, unit load device, pallet, or similar overpack would further enhance safety. DOT is requesting comments regarding this potential limitation, including potential safety benefits, possible cost impacts, and operational implications or alternative suggestions for reducing risk.
- Consolidate and simplify current and revised lithium battery requirements into one section of the HMR by relocating relevant provisions currently contained in special provisions to 49 CFR 173.185. Requirements for transporting lithium cells and batteries are located in several different special provisions in 49 CFR 172.102 and in 49 CFR 173.185.
- Apply appropriate safety measures for the transport of lithium cells or batteries identified as being defective for safety reasons, or those that have been damaged or are otherwise being returned to the manufacturer, and limit the transportation of defective or damaged cells or batteries to highway and rail.

PHMSA seeks comments about the impact of the proposed rule on infrequent shippers, and seeks data regarding the number of shipments, types of shipments, and costs incurred by these shippers. PHMSA also seeks comments about how communication of the requirements for transporters and infrequent shippers could be improved.